

Original Research Article

Prospective study of surgical site infection in laparotomy wounds with antibiotic lavage

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ABSTRACT

Background: Surgical site infection after operation is a burning issue increasing morbidity of the patient and increasing health care cost. Various strategies are there to reduce surgical infection one of which is lavage with antibiotic solution. Objective of the study was 1) to compare the incidence of post-operative wound infection in Laparotomy patients with contaminated and dirty wounds between patients who had per operative antibiotic lavage and patients who did not have per operative antibiotic lavage. 2) To compare the outcome of Superficial Surgical Site Infection (SSSI) between the two study groups.

Methods: This prospective randomized study carried out in emergency surgery department after institutional ethics committee clearance. 100 consenting patient divided into two groups either to receive peritoneal toileting with antibiotic (group A) or toileting with normal saline only (group B). Post operatively the patients were closely monitored for signs of wound infection. In patients with infected wounds the discharge was sent for culture sensitivity and the findings are noted. Standard practice of wound care was done (with regular dressings) in infected wounds and outcome of wound was recorded.

Results: This prospective randomized study carried out in emergency surgery department after institutional ethics committee clearance. 100 consenting patient divided into two groups either to receive peritoneal toileting with antibiotic (group A) or toileting with normal saline only (group B). Post operatively the patients were closely monitored for signs of wound infection. In patients with infected wounds the discharge was sent for culture sensitivity and the findings are noted. Standard practice of wound care was done (with regular dressings) in infected wounds, and outcome of wound was recorded.

Conclusions: In Group A, incidence of superficial infection was lower. In both the cases the most common organism responsible was *E. coli*.

Keywords: Surgical site infection, Antibiotic lavage, *E. coli*

INTRODUCTION

Surgical site infections continue to occur at an unacceptable rate, annually costing billions of dollars in economic loss caused by associated morbidity and

mortality.¹ The search for techniques that can minimize the risk is continually being refined and expanded.

Basic understanding of how the body defends itself against infection is essential to a rational application of

surgical and other therapeutic principles to the control of infection.²

In patients undergoing laparotomy with contaminated and dirty wounds the infection rate is 20% to 30% and 30% to 40% respectively.^{3,4} This study evaluates if this planned per-operative procedure can reduce the surgical site infection in these patients and efficacy of antibiotic (Gentamicin-160 mg/500 ml) lavage in preventing SSI in laparotomy patients.

Aims and objectives

To determine the effect of the planned preoperative intervention (antibiotic lavage with gentamicin) on superficial surgical site infection in laparotomy cases with contaminated and dirty wounds.

Specific objectives

- To compare the incidence of post-operative wound infection in laparotomy patients with contaminated and dirty wounds between patients who had per operative antibiotic lavage and patients who did not have per operative antibiotic lavage.
- To compare the outcome of Superficial Surgical Site Infection (SSSI) between the two study groups.
- To compare the rate of post-operative deep surgical site infection between these two groups.
- To compare the rate of post-operative complete wound dehiscence between these two groups.
- To compare the microorganism causing SSI between the two groups of patients.

METHODS

Patients of the Department of General Surgery, undergoing laparotomy with contaminated and dirty wounds were selected for the study.

Sample size

50 patients in each group of patients: a total of 100 patients.

Study design

Randomized prospective comparative study was conducted by simple random sampling using randomization table. A study was conducted from January 2014 to December 2014.

Parameters to be studied

- History and clinical examination.
- Full blood count, blood glucose, blood urea, serum creatinine.
- *Operative findings:* perforation, peritoneal content, wound contamination.

- Post-operative wound infection and culture sensitivity of the wound discharge.
- Incidence of superficial surgical site infection (SSSI).
- Incidence of deep surgical site infection (DSSI).
- Incidence of complete wound dehiscence (CWD).
- Outcome of infected wounds.

Study technique

- All the patients admitted in emergency surgery department who needed laparotomy were potential candidates for the study.
- Preoperative investigations were done (to complete the inclusion and exclusion criteria's as described).
- Intravenous antibiotic was given to all patients at induction of anaesthesia (1 g ceftriaxone and 500 mg of metronidazole-IV).
- At laparotomy the findings were noted, and the patients with dirty and contaminated wounds (as per criteria mentioned) were taken within the study and randomized into control and case population.
- All patients received peritoneal toilet with copious amount of normal saline. In addition-patients belonging to case group received about 750 ml of antibiotic lavage (gentamicin 320mg/1000ml of normal saline). About 50 ml of lavage solution is left inside the peritoneal cavity.
- After closure of the sheath in case group the wound was again washed with 250 ml of antibiotic lavage (Gentamicin 320mg/1000ml of normal saline) in addition to Normal Saline wash in all patients.
- Post operatively the patients were closely monitored for signs of wound infection.
- In patients with infected wounds the discharge was sent for culture sensitivity and the findings are noted.
- Standard practice of wound care was done (with regular dressings) in infected wounds, and outcome of wound was recorded.
- After discharge the patients were followed up in OPD after 1 month.

Plan for analysis of data

By using standard statistical software, in this study analysis was done using Medcalc 6.

Inclusion criteria

- Patients undergoing laparotomy with contaminated and dirty wounds.
- Patients between 18 to 60 year age group
- Patients of ASA I and II only.

Exclusion criteria

- Patients with associated solid organ injury and injuries in other areas (to exclude possibility of other infections influencing the study).

- Patients below 18 years and above 60 years.
- Patients with associated other postoperative infection like UTI, RTI etc.
- Patients with organ/space infection.
- Patients with diabetes/immunosuppressive states/serious systemic comorbidities.
- Malignant conditions.

Criteria for diagnosis of SSI

The USA Centers for disease control (CDC) states that only infections occurring within 30 days of surgery (or within a year in case of implants) should be classified as surgical site infections (SSI).^{5,6}

SSI is split into 3 groups; superficial SSI; deep SSI and organ space SSI as this study focuses on superficial SSI, it has been elaborated further.

Superficial SSI must meet the following 2 criteria

- Occur within 30 days of procedure.
- Involve only skin and subcutaneous tissue around the incision.

PLUS at least one of the following criteria

- Purulent drainage from the incision.
- Organisms isolated from an aseptically obtained culture of fluid/tissue from the incision.
- At least one of the following signs or symptoms of infection.
 - Pain/ tenderness at incision site
 - Localized swelling
 - Erythema or increased temperature
- Diagnosis of superficial incisional SSI by a surgeon or attending physician.

The classification of operative wounds based on the degree of microbial contamination are as follows

Clean: Elective, not an emergency, non-traumatic, primary closure, no acute inflammation. The respiratory system (RS), gastrointestinal system (GIT) biliary or genitourinary system (GUT) not entered.⁷

Clean contaminated: Emergency case which is otherwise clean; Elective opening of RS/GIT/biliary/GUT with min spillage (eg:appendectomy)⁷. Not encountering infected urine/bile

Contaminated: Non purulent inflammation; gross spillage from GIT; entry into biliary/GUT in presence of infected bile/urine; penetrating trauma<4 hrs. Old; chronic open wounds needing to be grafted/covered.

Dirty: Purulent inflammation (abscess); pre-op perforation of RS/GIT/biliary/GUT; penetrating trauma >4 hrs old.

RESULTS

Sex distribution shown in Table 1 and age distribution shown in Table 2. Demographically there was no significant difference in two groups.

Table 1: Sex distribution.

Sex	Group A	Group B
Male	33	32
female	17	18

Table 2: Age Distribution.

Age	Group A	Group B
18-30	8	8
30-40	12	16
40-50	16	14
50-60	14	12

Table 3: Incidence of different etiology of contaminated and dirty laparotomy.

Etiology	Group A	Group B
Peptic perforation	25	27
Jejunal perforation	5	3
Ileal perforation	10	12
Appendicular	10	8

Incidence of different etiology of contaminated and dirty laparotomy depicted in Table 3. Incidence of post-operative fever depicted in figure 4. 12 Patients in group A, had fever where as 15 patients in Group B had fever. For this set of data the chi-square statistic is 0.4566. The P value is 0.499207 which is not significant.

Table 4: Incidence of post-operative fever.

	Within 1 Week	Between 1 week-30 days	Total
Group A	4	8	12
Group B	4	11	15

Table 5: Incidence of local signs.

Local sign	Group A	Group B
Pain	12	18
erythema	14	20
temparature	12	19

Incidence of local signs depicted In Table 5. Incidence of type of Wound discharge depicted In Table 6. Incidence Of superficial surgical site infection depicted In Table 7

15 patients of Group A and 21 patients in Group B had incisional surgical site infection. For this set of data chi-square test p value is 0.2113. This result is not significant at p<0.05.

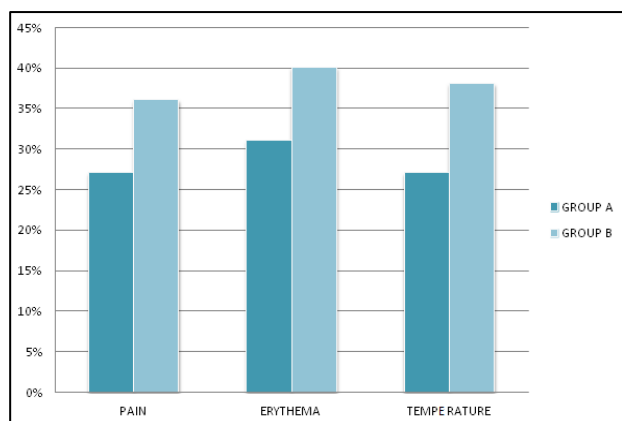


Figure 1: Comparative incidence of local sign.

Incidence of deep surgical site infection shown in Table 8. 6 Patients in Group A had presented with deep surgical site infection where 10.

Patients in Group B had presented with the same. The chi-square statistic is 1.1905. The P value is 0.275234. This result is not significant at $P < 0.05$.

Incidence of complete wound dehiscence (Cwd) is shown in Table 9. 4 Patients in Group A Had presented with complete wound dehiscence where 6 patients in Group B had presented with the same. The chi-square statistic is 0.4444. The P value is 0.504985. This result is not significant at $P < 0.05$.

Table 6: Incidence of type of wound discharge.

	Group A	Group B
Serous	1	2
Seropurulent	4	4
Purulent	10	15

Table 7: Incidence of superficial surgical site infection.

	SSSI	No evidence of SSSI	Total cases
Group A	15	35	50
Group B	21	29	50

Table 8: Incidence of deep surgical site infection.

	DSSI	NO evidence of DSSI	Total cases
Group A	6	44	50
Group B	10	40	50

Incidence of common organism isolated shown in Table 10. *E. coli* is the most common organism isolated. 9 patients in Group A and 12 patients in Group B presented with infection caused by *E. coli*.

Table 9: Incidence of complete wound dehiscence (CWD).

	Evidence of CWD	No evidence of CWD
Group A	4	44
Group B	6	40

Table 10: Incidence of common organism isolated.

	Group A	Group B
E coli	9	12
Klebsiella	3	4
Proteus	1	2
S aureus	2	2
S aureus	0	1

DISCUSSION

This randomized comparative study was conducted at the Department of General Surgery, Patients undergoing Emergency laparotomy with dirty and contaminated wounds after they met the inclusion and exclusion criteria were taken up for the study.

The study was conducted on over 100 patients and they were randomized into 2 groups. Group A was the interventional group and group B was the control group.

Sex

In Group A there are 50 patients among whom 33 patients were male and 17 patients were female. In group B there were 50 patients among whom 32 were male and 18 were female. In group A, M: F ratio was 1.83:1 and in group B, M: F ratio was 1.77:1- no significant difference in sex incidence in the groups.

Age

The patients were between 18 to 60 years, and most of the cases of laparotomy with dirty and contaminated wounds were between 40 to 50 yrs. No significant difference in age distribution was found.

Miki C, Ohmori Y, Araki T, Kusunoki M in their study had found that young patients (between 7 to 17 years old) are more prone to infection.⁸ Patients above 60 years are more prone to infection due to co-morbid and age related complications. So patients, who were below 18 years old and above 60 years old, were excluded from the study.

Incidence of different etiology of contaminated and dirty laparotomy

Table 3 shows the incidence of site of perforation 56% patients in group A and 54% patients in group B presented with peptic perforation. Peptic perforation was the leading cause of laparotomy with contaminated and

dirty wounds. Ileal perforation was the second most common cause. And these findings are consistent with the study done by Rajender Singh Jhobta where in 504 cases of perforation peritonitis found duodenum as the commonest site of involvement, followed by appendicitis, gastrointestinal perforation due to blunt trauma abdomen, typhoid fever and tuberculosis.⁹

Incidence of post-operative fever

Table 4 shows the incidence of fever. 12 patients in group A and 15 patients in group B had complained of fever. For this set of data the chi-square value is 0.13 and p value is 0.72, which again is statistically not significant.

Incidence of local signs

Table 5 shows the incidence of local signs. Local pain was present in 12 patients of group A and 18 patients of group B, similarly 12 patients in group A and 19 patients in group B had presented with increased local temperature. Erythema was present in 14 patients of group A and 20 patients of group B.

Incidence of type of wound discharge in both groups

Table 6 shows the incidence of type of pus discharge. 10 patients in group A (approximately 67%) and 15 patients in group B (approximately 71%) had presented with purulent discharge. 4 patients in each group had presented with sero-purulent discharge and serous discharge was present in 1 patients of group A and 2 patients of group B. Purulent discharge from wound is the most common type of discharge seen in both groups. There are numerous studies in world literature which shows similar results.

Incidence of superficial surgical site infection (SSSI)

Table 8 shows the incidence of SSSI in both the groups. 15 out of 50 patients in group A and 21 out of 50 patients in group B had shown features of SSSI. In the control group this incidence of SSSI was 42% and in the interventional group it was 30%. The incidence of wound infection in cases of dirty wound was 30%-40% in recent studies.^{3,4}

Though there was a difference in incidence of wound infection in both groups, for this set of data the chi-square value is 0.76 and p value is 0.22, which is not statistically significant.

Four randomized controlled trials have evaluated the use of gentamicin collagen sponges in cardiothoracic surgery. Three of these trials demonstrated a decrease in SSIs and one showed no difference.¹⁰⁻¹⁴ A recent meta-analysis combining these trials concluded that the risk of deep sternal wound infection was significantly lower in patients who received a gentamicin collagen sponge than

in patients who did not (RR, 0.62 [95% CI, 0.39-0.97]) despite significant heterogeneity among the trials.¹⁵

Hence, numerous studies with their significant findings advocate the use of topical antibiotic in reducing the rate of SSSI while others refute the routine use of topical antibiotics.

Incidence of deep surgical site infection

In the present study for this set of data the chi-square value is 1.19 and p value is 0.275. The difference in incidence of deep surgical site infection in both groups was not statistically significant. Few world literatures are there which corroborate our findings

Incidence of complete wound dehiscence

Table 9 shows the incidence of CWD. 2 patients in group A (approximately 4%) and 6 patients in group B (approximately 12%) had presented with CWD.

Although there was a difference in rate of CWD in the groups, for this set of data the chi-square value is 0.50 and p value is 0.44. The difference is not statistically significant. Few world literatures are there which corroborate our findings.

Comparative incidence of isolated organisms in both groups

Table 11 shows the comparative incidence of isolated organisms. *E. coli* was isolated from 9 patients in group A and 12 patients in group B. *E. coli* was the most common organism isolated in both groups and *Klebsiella* was the next common organism isolated from wound of 3 patients in group A and 4 patients in group B.

The reason for *E. coli* being most common organism is that majority of patients getting postoperative wound infection, have undergone surgery for hollow viscus perforation and *E. coli* being the most common organism found in intestinal flora, might have contaminated the wound.

Agarwal et al, shows predominants of *E. coli* as commonest organism in postoperative wound infection.¹⁶ Our values matches with the observations by Agarwal et al.

Knowly et al, shows that staphylococcus aureus as predominant microorganism isolated i.e. 45.6%.¹⁷ In our study staphylococcus is the fourth most common organism accounting for 12%. Our values do not match with the study conducted by Knowly et al.

CONCLUSION

Although there is a lower rate of superficial surgical site infection, deep surgical site infection, complete wound

dehiscence in the interventional group in our study- this difference with the control group is not statistically significant. Followings are some limitations of the study;

- The sample size of this study is small which may not reflect the true picture.
- The study is considered all the cases of laparotomy with dirty and contaminated wounds together. Ideally each etiology should have been dealt with separately. This may have shown significant outcome with specific etiological type of wound.
- The study has been conducted in a single institution which may not represent the true picture. A multicentric study would be more representative and powerful.

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